

Electronic Version 1.1

Stylesheet Version v1.1.1

## Description

### Composite Billiard cue shaft

#### BACKGROUND ART

[0001]

A billiard cue is basically a shaft that is more or less tapered from larger at the back end to smaller at the front end where there is attached a tip which makes the contact with the cue ball. Billiard cues may have one or more releasable joints along their length. The shaft or shafts that form the body of a billiard cue have been made from a great variety of materials; however none has yet proven to match the feel and performance of wood. Billiard cue shafts have been made from composite materials such as glass fiber/polyester and carbon fiber/epoxy. Prior tubular composite shafts have a constant wall thickness along their entire length probably for reasons of economy of manufacture. United States Patents #4,816,203, #6,110,051, and #6,736,733 describe constant wall tubular composite billiard cue shafts. The high strength to weight ratio, excellent stability, and high coefficient of restitution of modern composite materials should make them ideal for the construction of billiard cue shafts. However, to date, nearly all top players still prefer cues made from shafts of solid wood. When a cue ball is struck by a billiard cue, the force of the collision is taken by the cue straight down the shaft. The cue ball speed produced is primarily a function of the speed of the cue at the point of impact, the overall mass of the cue, and the coefficient of restitution of the cue. Composite materials themselves have a higher coefficient of restitution than wood, however prior designs have failed to take advantage of this and produce a livelier cue.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0002]

FIG. 1 shows the overall configuration of the common two piece billiard cue and how the present invention would fit into this configuration. A releasable joint at the middle point of the cue connects the front half to the back half. The front half includes a shaft 12, a tip cap 13, and a tip 14. The back half includes a shaft 11 and a butt cap 15. FIG. 2 shows a longitudinal cross section of the shaft 11 and how it might be joined to the butt cap 15 and to the back half of the middle joint 17. 16 indicates the location of the foam core. FIG. 3 shows a longitudinal cross section of the shaft 12 and how it might be joined to the front half of the middle joint 18 and the tip cap 13 which supports the tip 14. 19 indicates the location of the foam core. FIG. 4 shows a typical lateral cross section of shaft 11 or shaft 12. 16,19 indicates the location of the foam core.

## DISCLOSURE OF INVENTION

[0003]

The applicant has found through experimentation that the tubular composite shafts of constant wall thickness used to form prior art billiard cues do not provide satisfactory energy transfer or feel. The applicant has determined that by increasing the wall thickness of a tubular composite shaft gradually from front to back within a range, both the efficiency of energy transfer and the feel are improved when the shaft is used to form the body or even a portion of the body of a billiard cue. The lateral cross sectional area of a tapered solid wood shaft increases with the square of the diameter along its length and the cross sectional area of a constant wall tapered tubular shaft increases only directly with the diameter. It has been seen by the applicant that by building in a rate of increase of the cross sectional area of the tubular shaft to match or exceed that of solid shafts, that when used in billiard cues, those cues perform better even than solid shafted cues. A mechanical stroking device has been utilized to demonstrate that cues made from these improved shafts

produce more cue ball speed than cues made from prior art shafts, for a given speed of stroke and all other things being equal including the overall weight of the cue. It is apparent that the high coefficient of restitution of modern composite materials is better exploited by this design. Also noted is less vibration and improved feedback to the player.

A resilient foam core is known to further reduce unwanted vibration and quiet the otherwise hollow shafts and would be desirable in some models. A rigid foam core likewise dampens vibration somewhat and also works together with the strong skin like a sandwich effect to increase stiffness to weight ratio which would likewise be desirable in some models. In addition three "weights" are envisioned; lighter shafts with thinner walls for gentler games or for players with less powerful stroking technique, medium weight shafts, and heavier stronger shafts for the construction of cues made specifically for the break shot during which the impact forces are at their highest levels.